Padding and Stride

What if we want the output to be the same size as the input?

1. Let us consider adding extra rows+columns of zeros so that we can access all the image pixels

7x7 input, 3x3 kernel and padding of 1.
The zeros denote the padding layer of 1.

Here, output remains 7x7 when a 3x3 kernel is used. Need extra padding for 5x5 kernel.
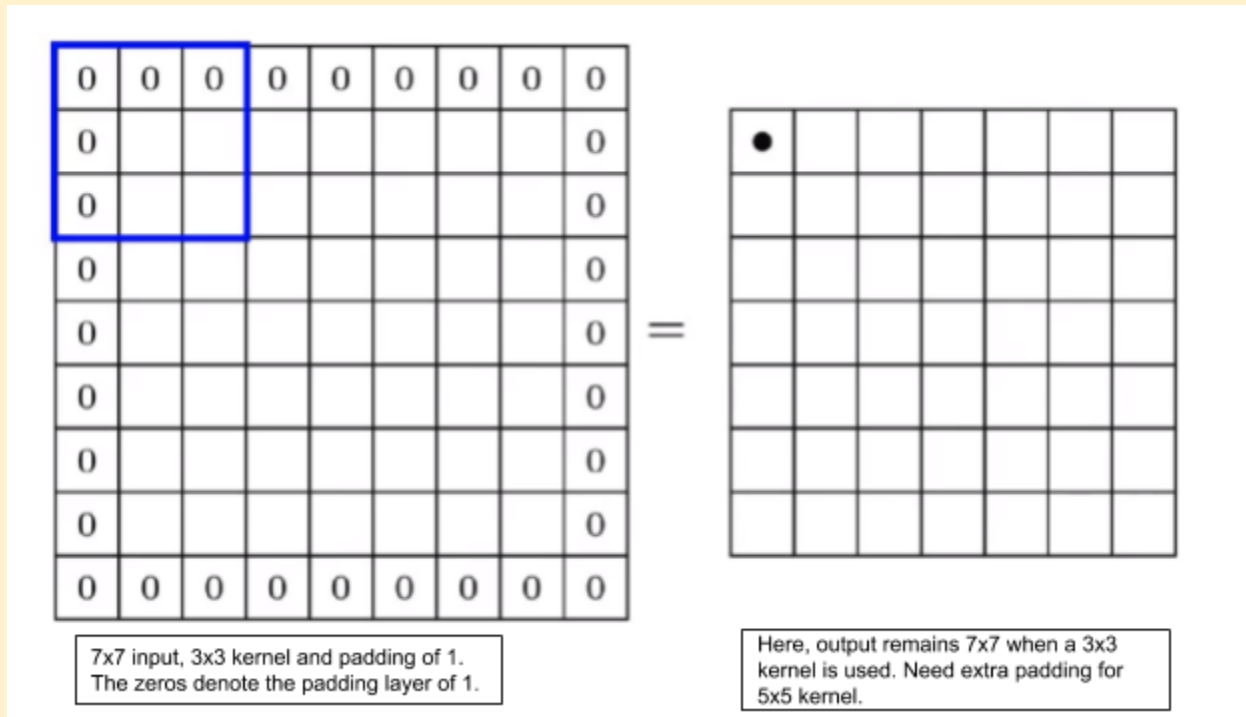
    a. We can see that we must apply padding to preserve the output size

    b. The bigger the kernel size, the larger the padding required.

2. Thus, the formulae from the last section can be updates as follows

    a. $W_O = W_I - F + 2P + 1$

    b. $H = H_I - F + 2P + 1$

3. Another term that we use is called stride (S). It also affects the size of the output image.

Input 7x7
Kernel 3x3
Padding 1
Stride 2
Output 4x4
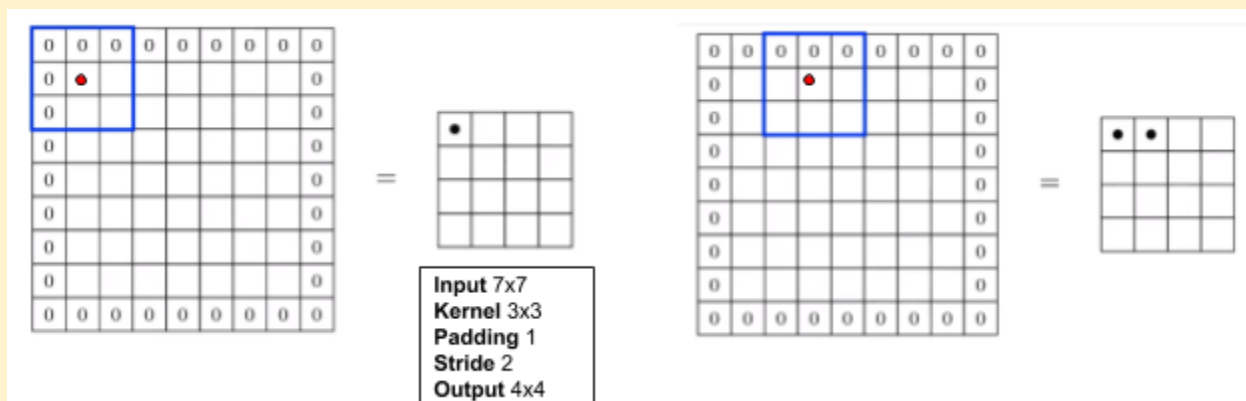
    a. Stride defines the interval at which the filter is applied

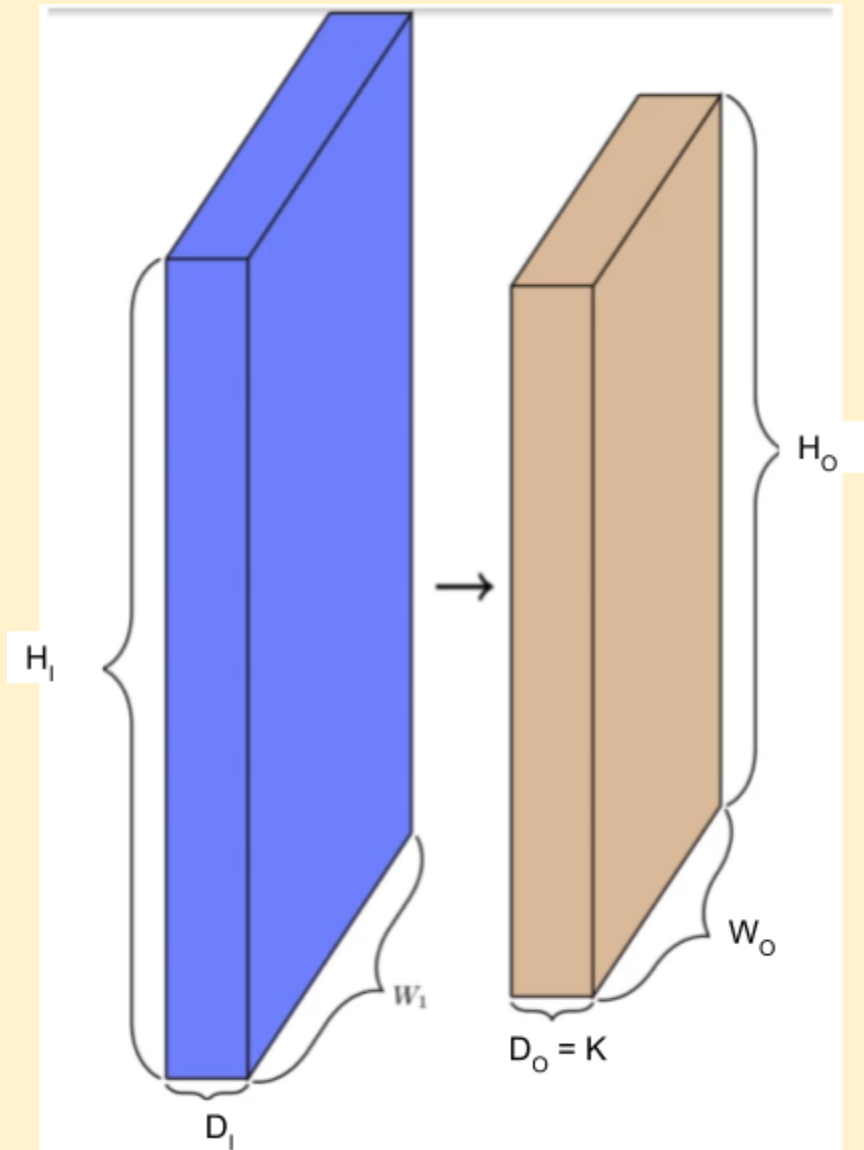   b. Higher the stride, the smaller the size of the output

4. We can see that the reduction in size can be given by the following equations
   a. $W_O = \frac{W_I - F + 2P}{S} + 1$
   b. $H_O = \frac{H_I - F + 2P}{S} + 1$
5. How do we compute the depth D of the output?
6. Consider the following image of a convolution operation

7. Each filter gives on 2D output
8. K filters will give K such 2D outputs
9. The depths of the output is the same as the number of filters
10. Thus, our final set of formulae are
    a. $W_O = \frac{W_I - F + 2P}{S} + 1$
    b. $H_O = \frac{H_I - F + 2P}{S} + 1$
    c. $D_O = K$